NBB Enclosed Particle Receiver

National Renewable Energy Laboratory

Award Number: EE0001586 | April 15, 2013 | Ma

PROJECT OBJECTIVES

Goal: This project will develop a near-blackbody particle receiver and an integrated fluidized-bed heat exchanger to achieve >20% cost reduction and overcome solar energy conversion performance and cost barriers.

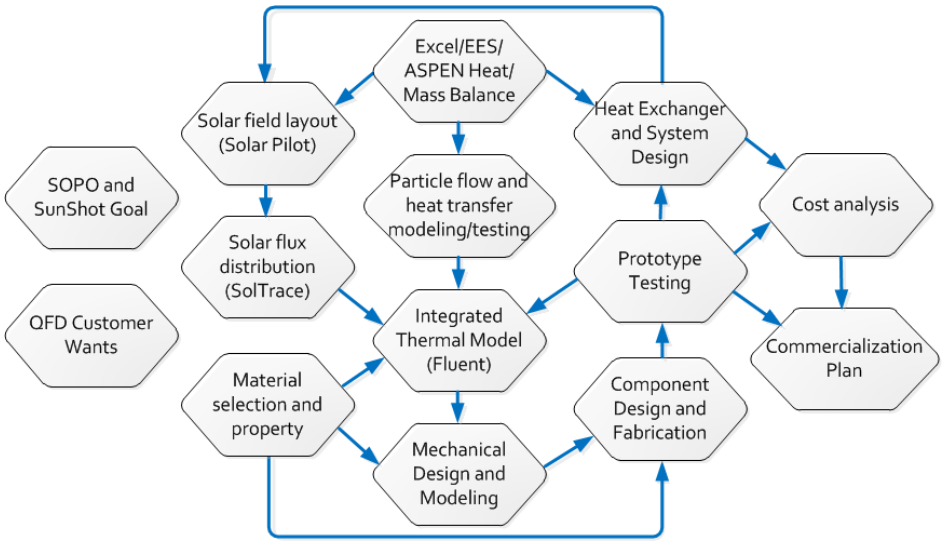
Innovation:

- Gas/solid two-phase flow as heat transfer fluid, and separated solid particles as storage media for low-cost, high-performance CSP with TES.
- Innovative receiver design and prototype fabrication.
- Near-blackbody absorber design to augment receiver efficiency.
- Fluidized-bed heat exchanger to support high-efficiency power cycles.

Milestones: Complete the milestone due on March 31, 2013.

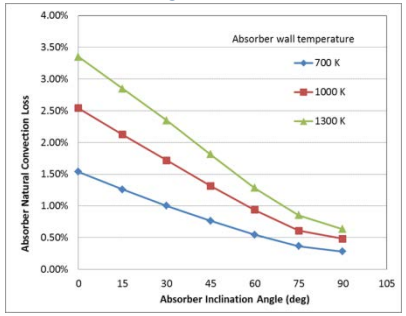
- Preliminary design of receiver and critical components to generate 6-sigma design matrix QFD Table.

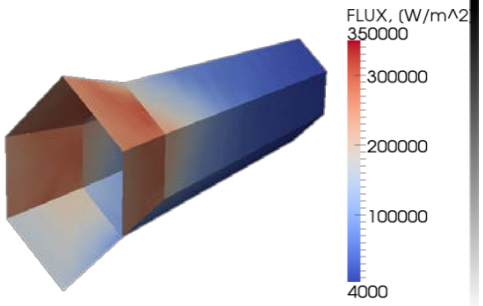
APPROACH



KEY RESULTS AND OUTCOMES

- NREL SolTrace absorber model shows reflective loss of approximately 1%.
- Absorber losses are low and incoming solar flux well spreads on reflective surfaces.
- Fluent results predicts absorber natural-convection loss <2%.
- Discrete Phase Model (DPM) depicts particle flow pattern.
- Developing particle flow and heat transfer test system.





NEXT MILESTONES

- The milestones and anticipated dates:
  - M(T-1.1) Preliminary receiver design and performance prediction (9/30).
  - M(T-1.2) Identify testing data on heat-transfer rate with wide operating conditions that can be used for heat-transfer analyses (9/30).
  - M(T-1.3) Select and characterize materials including particles and ceramics. Use the properties for modeling and design (9/30).
  - M(T-1.4) Generate PFD, heat/mass balance, preliminarily down-select and size equipment (9/30).
- All subcontracts were signed. Companies delayed in contracting are catching up with the development schedule.